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09/854,673	05/15/2001	Toshimitu Kimura	040679/1263	1146

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EXAMINER	
WILKINS III, HARRY D	
ART UNIT	PAPER NUMBER
1742	14

DATE MAILED: 07/01/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/854,673	KIMURA ET AL.	
	Examiner	Art Unit	
	Harry D Wilkins, III	1742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 August 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5,7-11,13 and 16-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,7-11,13 and 16-28* is/are rejected.

7)☒ Claim(s) *13* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 May 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114 was filed in this application after appeal to the Board of Patent Appeals and Interferences, but prior to a decision on the appeal. Since this application is eligible for continued examination under 37 CFR 1.114 and the fee set forth in 37 CFR 1.17(e) has been timely paid, the appeal has been withdrawn pursuant to 37 CFR 1.114 and prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submissions filed on 7 March 2003 and 20 August 2003 have been entered.

Claim Objections

2. Claim 13 is objected to because of the following informalities: claim 13 now depends on cancelled claim 6. Examination will be based upon the assumption that claim 13 should depend from claim 5 (old claim 6's parent claim). Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claim 20 is rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for the composition, except for the range of Si, and the method, does not reasonably provide enablement for the entire claimed scope of composition of Si. The specification does not enable any person skilled in the art to

which it pertains, or with which it is most nearly connected, to make and use the invention commensurate in scope with these claims. The claimed scope of composition could include 0.41 wt% Si, 1.0 wt% Si, 2.0 wt% Si, 3.0 wt% Si or even 4.0 wt% Si. The entire scope of the claimed composition is not been enabled by the specification. In addition, one of ordinary skill in the art would not be able to practice this invention without undue experimentation in order to find the maximum amount of Si that can be present in the steel. The Examiner asserts that there is still some uncertainty to the actual scope of claim 20, in that it is unclear what the actual range of Si sought to be protected by a patent is.

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 20 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

7. The term "relatively small amount" in claim 20 is a relative term which renders the claim indefinite. The term "relatively small amount" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The scope of the range of Si is not definite.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Watari et al (US 5,922,145) in view of "Annealing of Steel".

Watari et al teach a machine structural steel composition. The composition contains (see col 2, lines 50-67) 0.2-0.6 wt% C, 0.05-1.5 wt% Si, 0-2 wt% Ni, 0-2 wt% Cr, 0-0.5 wt% Mo.

Watari et al do not teach that the steel is subjected to spheroidizing.

"Annealing of Steel" teaches (see pages 46-47) that spheroidizing is performed to improve the cold formability of steels. Therefore, it would have been obvious to one of ordinary skill in the art to have applied spheroidizing to the steel of Watari et al for the conventional purpose of improving the cold formability of the steel.

Though Watari et al and "Annealing of Steel" do not teach the function of Cr and Mo as claimed, the values of Cr and Mo disclosed by Watari et al are within the claimed range and one of ordinary skill in the art would have expected the machine structural steel to have the carbides of less than 1 μm average size and less than 3 μm maximum size because the composition taught by Watari et al and the processing step taught by "Annealing of Steel" are identical to the claimed process.

Regarding the claimed processing parameters, "Annealing of Steel" teaches (see middle column, page 46) that spheroidizing can be heating to a temperature just above Ac_1 followed by very slow cooling in the furnace. The ASM Handbook article provides (see middle column of page 46) a clear teaching as to how to achieve spheroidizing,

and the variables necessary to achieve spheroidizing (temperature and cooling rate, per thrid example). Thus, the prior art does teach which parameters are critical in the spheroidizing operation. Table 4 (see page 47) discloses the general method of spheroidizing for low-alloy steels to obtain a ferritic/spheroidized carbide structure includes heating at about 700-800°C and cooling to about 600°C at a rate of 5°C/hr. The closest composition in Table 4 to the presently claimed composition is 9840 steel, which has a nominal composition of 0.40 wt% C, 1.00 wt% Ni, 0.80 wt% Cr and 0.25 wt% Mo. In addition, the ASM Handbook provides (see page 47, middle and right cols.) that low-carbon steels produce "gummy" steels when spheroidized due to a low hardness, but that when carbon or alloy content is increased, the hardness increases. Thus, when the alloy content, such as Cr and Mo, was increased, as it is in the alloy of Watari et al compared to the prior art 9840 alloy, one of ordinary skill in the art would have expected the ability of the low-carbon steels to be machined after spheroidizing to have increased because of the increased hardness. Therefore, it would have been obvious to one of ordinary skill in the art to have applied the conventional spheroidizing treatment to the steel of Watari et al because the conventional treatment produces a fine ferritic/spheroidized carbide structure in low alloy steels with the improvement in cold formability discussed above.

10. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shibata et al (US 4,773,947) in view of "Annealing of Steel".

Shibata et al teach a steel composition that contains (see abstract) 0.03-0.2 wt% C, 1-3 wt% Si, up to 2 wt% Cr, up to 0.5 wt% Mo and up to 2 wt% Ni. The composition of Shibata et al overlaps the presently claimed composition.

Shibata et al do not teach that the steel is subjected to spheroidizing.

"Annealing of Steel" teaches (see pages 46-47) that spheroidizing is performed to improve the cold formability of steels. Therefore, it would have been obvious to one of ordinary skill in the art to have applied spheroidizing to the steel of Shibata et al for the conventional purpose of improving the cold formability of the steel.

Though Shibata et al and "Annealing of Steel" do not teach the function of Cr and Mo as claimed, the values of Cr and Mo disclosed by Shibata et al are within the claimed range and one of ordinary skill in the art would have expected the machine structural steel to have the carbides of less than 1 μm average size and less than 3 μm maximum size because the composition taught by Shibata et al and the processing step taught by "Annealing of Steel" are identical to the claimed process.

Regarding the claimed processing parameters, "Annealing of Steel" teaches (see middle column, page 46) that spheroidizing can be heating to a temperature just above Ac_1 followed by very slow cooling in the furnace. The ASM Handbook article provides (see middle column of page 46) a clear teaching as to how to achieve spheroidizing, and the variables necessary to achieve spheroidizing (temperature and cooling rate, per thrid example). Thus, the prior art does teach which parameters are critical in the spheroidizing operation. Table 4 (see page 47) discloses the general method of spheroidizing for low-alloy steels to obtain a ferritic/spheroidized carbide structure

includes heating at about 700-800°C and cooling to about 600°C at a rate of 5°C/hr. The closest composition in Table 4 to the presently claimed composition is 9840 steel, which has a nominal composition of 0.40 wt% C, 1.00 wt% Ni, 0.80 wt% Cr and 0.25 wt% Mo. In addition, the ASM Handbook provides (see page 47, middle and right cols.) that low-carbon steels produce "gummy" steels when spheroidized due to a low hardness, but that when carbon or alloy content is increased, the hardness increases. Thus, when the alloy content, such as Cr and Mo, was increased, as it is in the alloy of Shibata et al compared to the prior art 9840 alloy, one of ordinary skill in the art would have expected the ability of the low-carbon steels to be machined after spheroidizing to have increased because of the increased hardness. Therefore, it would have been obvious to one of ordinary skill in the art to have applied the conventional spheroidizing treatment to the steel of Shibata et al because the conventional treatment produces a fine ferritic/spheroidized carbide structure in low alloy steels with the improvement in cold formability discussed above.

11. Claims 1-3, 5, 13, 20-22, 24, 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Eguchi et al (US 5,746,842) in view of "Annealing of Steel".

Regarding claim 5, Eguchi et al teach a steel composition that contains (see col 2, lines 40-65) 0.1-0.35 wt% C, 0.5-2.5 wt% Si, 0.01-2.5 wt% Cr, 0.01-0.7 wt% Mo and 0.01-2 wt% Ni. The composition of Eguchi et al overlaps the presently claimed composition for every element except C. However, it would have been within the expected skill of a routineer in the art to have optimized the composition of C in the steel in order to maximize the strength of the steel (see col 5, lines 58-59). The upper

endpoints of the Cr and Mo ranges are treated as disclosed points. Therefore, Eguchi et al teach a steel with 3.2 wt% Cr+Mo.

Eguchi et al do not teach that the steel is subjected to spheroidizing.

"Annealing of Steel" teaches (see pages 46-47) that spheroidizing is performed to improve the cold formability of steels. Therefore, it would have been obvious to one of ordinary skill in the art to have applied spheroidizing to the steel of Eguchi et al for the conventional purpose of improving the cold formability of the steel.

Regarding the limitation on the size of the carbides, one of ordinary skill in the art would have expected the carbides formed by the spheroidizing treatment of "Annealing of Steel" to have less than 1 μm average size and less than 3 μm maximum size because the composition taught by Eguchi et al and the processing step taught by "Annealing of Steel" are identical to the claimed process.

Regarding the claimed processing parameters, "Annealing of Steel" teaches (see middle column, page 46) that spheroidizing can be heating to a temperature just above Ac_1 followed by very slow cooling in the furnace. The ASM Handbook article provides (see middle column of page 46) a clear teaching as to how to achieve spheroidizing, and the variables necessary to achieve spheroidizing (temperature and cooling rate, per thrid example). Thus, the prior art does teach which parameters are critical in the spheroidizing operation. Table 4 (see page 47) discloses the general method of spheroidizing for low-alloy steels to obtain a ferritic/spheroidized carbide structure includes heating at about 700-800°C and cooling to about 600°C at a rate of 5°C/hr. The closest composition in Table 4 to the presently claimed composition is 9840 steel,

which has a nominal composition of 0.40 wt% C, 1.00 wt% Ni, 0.80 wt% Cr and 0.25 wt% Mo. In addition, the ASM Handbook provides (see page 47, middle and right cols.) that low-carbon steels produce "gummy" steels when spheroidized due to a low hardness, but that when carbon or alloy content is increased, the hardness increases. Thus, when the alloy content, such as Cr and Mo, was increased, as it is in the alloy of Eguchi et al compared to the prior art 9840 alloy, one of ordinary skill in the art would have expected the ability of the low-carbon steels to be machined after spheroidizing to have increased because of the increased hardness. Therefore, it would have been obvious to one of ordinary skill in the art to have applied the conventional spheroidizing treatment to the steel of Eguchi et al because the conventional treatment produces a fine ferritic/spheroidized carbide structure in low alloy steels with the improvement in cold formability discussed above.

Regarding claim 1, Eguchi et al teach (as above) a composition that contains the presently claimed composition. One of ordinary skill in the art would have expected the carbides formed by the spheroidizing treatment of "Annealing of Steel" to have less than 1 μm average size and less than 3 μm maximum size as claimed because the composition taught by Eguchi et al and the processing step taught by "Annealing of Steel" are identical to the claimed process.

Regarding claims 2 and 13, the composition of Eguchi et al is identical and the process of "Annealing of Steel" is identical to the claimed composition and method. Therefore, one of ordinary skill in the art would have expected the steel to contain at least one type of carbide selected from MC, M_2C, M_7C_3, $M_{23}C_6$ and M_6C.

Regarding claim 3, "Annealing of Steel" teaches (see Table 4, page 47) that the typical hardness after spheroidizing is 163-212 HB. This converts to about 168-217 HV. Therefore, one of ordinary skill in the art would have expected the steel of Eguchi et al in view of "Annealing of Steel" to have the Vickers hardness as claimed.

Regarding claim 20, though Eguchi et al and "Annealing of Steel" do not teach the function of Cr and Mo as claimed, the values of Cr and Mo disclosed by Eguchi et al are within the claimed range and one of ordinary skill in the art would have expected the machine structural steel to have the carbides of less than 1 μm average size and less than 3 μm maximum size because the composition taught by Eguchi et al and the processing step taught by "Annealing of Steel" are identical to the claimed product. See discussion above regarding the processing parameters.

Regarding claims 21, 22 and 24, the upper endpoints of the Cr and Mo ranges are treated as disclosed points. Therefore, Eguchi et al teach a steel with 3.2 wt% Cr+Mo.

Regarding claims 26 and 27, "Annealing of Steel" teaches (see pages 46-47) that the spheroidizing is applied to ease the ability of the steel to be machined. Therefore, one of ordinary skill in the art would have expected the heat treatment to be carried out prior to any machining.

12. Claims 4, 7-11, 16-19, 23, 25 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Eguchi et al (US 5,746,842) in view of "Annealing of Steel" as applied to claims 1-3, 5, 13, 20-22, 24, 26 and 27 above, and further in view of "Introduction to Surface Hardening of Steels" and "Tempering of Steel".

Regarding claim 7, the teachings of Eguchi et al and "Annealing of Steel" are discussed above in paragraph no. 11.

The method disclosed by "Annealing of Steel" does not include performing carburizing or carbonitriding, followed by tempering, after the spheroidizing.

"Introduction to Surface Hardening of Steels" teaches (see page 259, 1st column) that surface hardening is used to improve the wear resistance of parts without affecting the tough interior of the part. "Introduction to Surface Hardening of Steels" describes, on pages 260-263, the most conventional method of surface hardening, carburizing.

"Tempering of Steel" teaches (see page 121) that tempering is a process that is used on previously hardened steel to increase ductility and toughness.

Therefore, it would have been obvious to one of ordinary skill in the art to have applied carburizing, as taught by "Introduction to Surface Hardening of Steels", and tempering, as taught by "Tempering of Steel", to the steel of Eguchi et al in view of "Annealing of Steel" because the carburizing improves the wear resistance of the surface of the steel and the tempering restores toughness to the surface of the steel.

It would have been within the expected skill of a routineer in the art to have performed machining on the part of Eguchi et al in view of "Annealing of Steel" before the carburizing in order to get the part into the final desired shape before the hard case was formed during carburizing.

Regarding claim 4, because the composition and process taught by Eguchi et al in view of "Annealing of Steel", "Tempering of Steel" and "Introduction to Surface Hardening of Steels" are identical to the presently claimed invention, one of ordinary

skill in the art would have expected the carbides formed by the spheroidizing treatment of "Annealing of Steel" to have less than 1 μm average size and less than 3 μm maximum size as claimed.

Regarding claims 14 and 15, "Annealing of Steel" teaches (see middle column, page 46) that spheroidizing can be heating to a temperature just above Ac_1 followed by very slow cooling in the furnace. Table 4 (see page 47) discloses the general method of spheroidizing for low-alloy steels to obtain a ferritic/spheroidized carbide structure includes heating at about 700-800°C and cooling to about 600°C at a rate of 5°C/hr. Therefore, it would have been obvious to one of ordinary skill in the art to have applied the conventional spheroidizing treatment to the steel of Eguchi et al because the conventional treatment produces a fine ferritic/spheroidized carbide structure in low alloy steels with the improvement in cold formability discussed above.

Regarding claims 8 and 16, the composition of Eguchi et al is identical and the process of "Annealing of Steel" is identical to the claimed composition and method. Therefore, one of ordinary skill in the art would have expected the steel to contain at least one type of carbide selected from MC, M_2C, M_7C_3, $M_{23}C_6$ and M_6C.

Regarding claims 9 and 17, Eguchi et al disclose (see title) that the steel is made into a gear, which is part of a variable transmission.

Regarding claims 10 and 18, "Introduction to Surface Hardening of Steels" teaches the first treatment is used to harden the surface.

Regarding claims 11 and 19, carbonitriding is known to be a functional equivalent to carburizing for the function of surface hardening (see "Introdutcion to Surface

Hardening of Steels" at Table 1 on page 259). Therefore, it would have been obvious to one of ordinary skill in the art to have substituted the known functional equivalent of carbonitriding for the carburizing.

Regarding claims 23 and 25, the upper endpoints of the Cr and Mo ranges are treated as disclosed points. Therefore, Eguchi et al teach a steel with 3.2 wt% Cr+Mo.

Regarding claim 28, "Annealing of Steel" teaches (see pages 46-47) that the spheroidizing is applied to ease the ability of the steel to be machined. Therefore, one of ordinary skill in the art would have expected the heat treatment to be carried out prior to any machining.

Response to Arguments

13. Please reference the Advisory action (Paper no. 8) for responses to the arguments presented in the 7 March 2003 filing.

14. Applicant's arguments filed 5 August 2003 have been fully considered but they are not persuasive. Applicant argued that:

a. There is no motivation to combine "Annealing of Steel" with Eguchi;

b. The combination does not teach all claimed elements;

c. Neither Eguchi et al nor "Annealing of Steel" teach that spheroidizing results in carbide precipitation; and,

d. The 112 rejections of claim 20 should be withdrawn.

In response to Applicant's first argument, as discussed in the advisory action, the increased alloy content of the steel of Eguchi et al removes the negative teaching against applying spheroidizing to low carbon steels. "Annealing of Steel" teaches that

increasing the alloy content of a steel improves the hardness, thus, the increased alloy content of the alloy of Eguchi et al over a normal low carbon steel, would provide the necessary hardness increase to allow spheroidizing to be applied.

In response to Applicant's second argument, "Annealing of Steel", in Table 4, provides examples of spheroidizing, particularly steel 9840, which has a similar composition, only higher carbon, but lower Ni and Cr. Thus, one of ordinary skill in the art would have expected the steel of Eguchi et al to use similar processing parameters, such as annealing at 74°C and slow cooling at 5°C/hr.

In response to Applicant's third argument, "Annealing of Steel" teaches (see sentence spanning 1st and 2nd cols. on page 46) that carbides are present as either lamellae in pearlite or as spheroids. Based on Table 4, the carbides formed by the spheroidizing are spheroids dispersed in a ferrite matrix.

In response to Applicant's fourth argument, while the Examiner admits that 5 or 10 wt% is outside the range of "relatively small amount", there is still uncertainty in the claimed range. One of ordinary skill in the art would not be certain if a given composition infringed upon claim 20. Is the cut off at 1.3 wt%? How about 1.5 wt%? Could it be construed that the claim includes values up to 2.0 wt%? The second paragraph of section 112 states:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Thus, Applicant has failed to meet the requirement of particularly pointing out and distinctly claiming the subject matter. Also the first paragraph of section 112 states:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it

pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Thus, Applicant has failed to use concise and exact terms which enables any person skilled in the art to make and use the invention.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry D Wilkins, III whose telephone number is 703-305-9927. The examiner can normally be reached on M-Th 10:00am-8:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy V King can be reached on 703-308-1146. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9306 for regular communications and (703) 872-9306 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Harry D Wilkins, III
Examiner
Art Unit 1742

hdw

ROY KING
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700